REMARKS

Applicant gratefully acknowledges the Examiner's statement that claims 4, 8, 11-16, 21 and 24-28 recite allowable subject matter. Claims 1-31 are pending in the present application. Claims 1, 4, 6, 8-11, 18, 21, 23, 24, 27 and 31 have been amended. No new matter has been introduced.

The drawings stand objected to based on certain informalities. A set of replacement drawing sheets are attached. FIGS. 1-4 have been amended to address the concerns of the Examiner. Applicant has amended FIGS. 1-4 to include the legend "Prior Art." Applicant has also amended FIG. 2 to change the spelling of "linearizer" and "quantizing." Applicant respectfully submits that the objection to the drawings should be withdrawn.

The disclosure stands objected to based on certain informalities. Applicant has amended each respective paragraph to address the concerns of the Examiner. Applicant respectfully requests that the objection to the disclosure be reconsidered.

Claims 1, 4, 6, 8-11, 23, 24, 27 and 31 stand objected to based on certain informalities noted by the Examiner. Applicant has amended the claims to address the Examiner's concerns. Applicant respectfully requests that the objection to the claims be reconsidered.

Claim 7 stands rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement, on the grounds that the specification does not explicitly describe how to use shifters instead of multipliers to simplify the implementation of the loop filter coefficients. This rejection is respectfully traversed.

Applicant respectfully submits that the specification does not explicitly describe the use of shifters because such an arrangement would have been well within

the knowledge of one of ordinary skill in the art. As stated on page 14 of the specification, the arrangement has a low sensitivity to changes in the coefficients and therefore the value of the coefficients does not need to be accurately reproduced. The example given on page 14 is that if the calculated optimum coefficient value is 1.2334, this value can be replaced by a coefficient such as 1 or 1.25 because the low sensitivity of the arrangement means that the difference in the actual coefficient value used does not significantly affect the operation.

An arrangement that requires a coefficient such as 1 or 1.25 can be simply implemented using a small number of shifters and adders. The specification indicates that the multipliers can be replaced by single shifters or by the addition of two or three shifters (page 7, lines 3-6). The former can be used for multiplying by 2^M, whereas the latter can be used for more accurate coefficients.

Applicant has attached hereto a sheet showing a number of examples, known to one of ordinary skill in the art, of using shifters and adders to provide simple multipliers. FIG. A shows a circuit having a fixed coefficient of 1.25. FIG. B shows a simple circuit for multiplying by a fixed coefficient of 4. FIG. C shows how a variable coefficient system could be implemented using two shifters, two adders and three switches to provide coefficients between 0 and 1.75. The schematic switches in FIG. C, either, allow the input to pass through or provide a 0 output. FIG. D shows how two serial left shifters such as those of FIG. B could be implemented by simply rearranging the connections between components in a parallel implementation. In a serial implementation, each shift could be implemented by a single bit delay, e.g., a D-type. The examples given are basic circuit designs, and one skilled in the art would understand how to implement such designs in the absence of an express teaching in the specification.

In view of the foregoing, Applicant respectfully submits that the claimed subject matter is supported by the specification. Accordingly, Applicant respectfully requests that the enablement rejection be withdrawn.

Claims 18-20, 22, 23 and 29-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the admitted prior art ("APA"), in view of Roza (U.S. Patent No. 4,467,291). The rejection is respectfully traversed.

APA relates to a word length reduction circuit for quantizing an input signal into an output signal. However, as the Examiner recognizes, APA does not contain a feedback loop.

Roza relates generally to a delta modulator comprising a feedback loop including a loop filter. However, Roza is concerned with the design of the loop filter rather than the arrangement of the delta modulator. Claim 1 of Roza clearly states that the improvement is in providing a loop filter which is a minimum-phase network, having specific phase characteristics. Roza describes two arrangements, one where the loop filter is provided in the feedback path and one where the filter is provided between the difference producer and the quantizer. Other than these general arrangements, there is no suggestion in Roza of modifying the arrangement such as in the present invention.

The Examiner indicates that the transfer function of the arrangement in Roza would have a noise transfer function which is functionally equivalent to that in the equation given in Claim 31. The transfer function of the circuit in Roza is:

$$Y(z) = X(z)/(1 + F(w)) + E(z)/(1 + F(w)),$$

where X(z) is the input and E(z) is the noise.

The Examiner is correct in suggesting that the transfer function for the noise in Roza is the same as in Claim 31. However, the transfer function for the input signal (which is the same as for the noise in Roza) is not unity and hence the input signal is filtered. Claim 31 specifically recites that the input signal is unfiltered and this is clearly apparent from the equation on page 13 of the present application.

One of the objects of the present invention is to provide an unfiltered input signal while providing filtering of the noise. There is no suggestion in the acknowledged prior art or in the Roza document of providing an arrangement having a loop filter and in which the input signal is unfiltered but with appropriate filtering of the noise. It is therefore not clear how one of ordinary skill would have been able to apply anything from Roza to the admitted prior art. The reference in Roza, column 1, line 24 merely indicates a desire to improve the signal-to-quantization noise ratio, rather than providing any teaching of how to achieve it in the manner described in Claim 31.

The Office Action does not clearly set forth the Examiner specific contentions as to how the steps of claim 18 are met by the combination of APA and Roza. Claim 18 recites a circuit having a feedback loop incorporating a loop filter. In this aspect, the invention is similar to Roza. However, claim 18 further includes the important feature of having an inner feedback loop coupled between the output and the input of the loop filter. There is no such inner feedback loop shown or suggested in Roza or in the acknowledged prior art. This inner feedback loop provides the desirable transfer function shown in the equation on page 13. This also allows the easier to implement sigma-delta loop filter G(z) to be used. Therefore again, it is not clear how the skilled man starting with the admitted prior art and Roza would be taught to provide the additional inner feedback loop in order to arrive at the present invention.

Claims 1, 2, 3, 5, 6, 9, 10 and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the APA in view of Roza, further in view of Fujimori (U.S. Patent No. 4,654,711). The rejection is respectfully traversed.

Fujimori describes providing a local feedback loop coupled across the output and input nodes of at least one latter order integrator within the first stage and subsequent stage of a converter. However, Fujimori's feedback loop is provided across the integrator stage in the feedforward path of a delta-sigma modulator. This would be equivalent to providing a local feedback loop within the function G(z) in Figure 5 of the present application. There is no suggestion in Fujimori of providing a feedback loop having a loop filter within it which also has an inner feedback loop coupled between the input of the loop filter and the output of the loop filter.

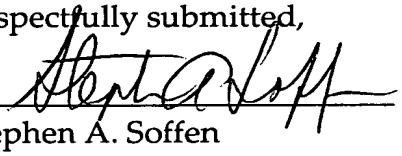
The Examiner suggests that Fujimori provides some notion of feedback loop teachings which could be applied to the APA/Roza combination. The Examiner suggests that the motivation would have been to maintain high signal-to-noise ratio. Again this is merely a statement of the desirability of the resultant circuit. As is set out in the Abstract of Fujimori, the purpose of the Fujimori invention is to use the local feedback loop to monitor the output from the connecting integrator and to modify the output using the local feedback to ensure the input level of the second and subsequent stages is optimally maintained. Fujimori sets out to suppress quantization noise in conjunction with the logic of Figure 10 of Fujimori. This is quite different than the present invention, which provides an arrangement which allows reuse of the G(z) filter. It is therefore not clear why one of ordinary skill starting with the APA/Roza combination would see any value in applying the teaching of Fujimori, as this clearly relates to a different aspect of the design of such circuits.

It appears that the Examiner is applying a degree of hindsight in suggesting that such a combination would have been obvious. The present invention aims to provide an improvement over the admitted prior art while avoiding unnecessary complexity or reduction in performance in other areas. Simply cherry-picking selected features from Roza and Fujimori does not demonstrate an obvious process of development that a skilled man would, rather than could, have followed, other than that the documents are in a related field. There is no indication as to why a skilled man would have applied the teaching of the cited documents to the admitted prior art to arrive at the present invention. Accordingly, applicant submits that the present invention as currently claimed is both novel and nonobvious over the prior art.

In view of the foregoing amendment, Applicant submits that the present application is in condition for allowance, and such action is earnestly solicited.

Dated: August 11, 2005

Respectfully submitted,

By 

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AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings include changes to FIGS. 1-4 as described in the "Remarks" section of this Amendment. The attached sheets replace the originally filed sheets containing FIGS. 1-4.

Attachment: Replacement sheets